

New York, N. Y., was thirty-two miles from the north. Brisk and high northeasterly winds continued on the northern New England coast during the 20th, but the storm apparently disappeared after reaching northern New England. The western branch of this disturbance, after reaching the lower lake region, apparently passed to the north of Lake Huron, and it was quickly followed by a storm from the southwest traced as number vi.

VI.—This disturbance was first observed in northern Texas in the southeast portion of a barometric trough which extended over the Rocky Mountain regions and the north Pacific coast. During the preceding day a general storm had prevailed over the Pacific coast and the north-central plateau regions, attended by heavy rains as far south as southern California, the centre of disturbance being on the north Pacific coast where the barometer was unusually low, that at Fort Canby, Wash., being 29.38 on the morning of the 19th. The pressure increased rapidly on the north Pacific coast during the night of the 19th, and the barometric trough moved eastward to the central valleys during the 20th, the disturbance over northern Texas becoming more clearly defined as it approached the lower Mississippi valley. On the morning of the 21st it was central near Cairo, Ill., and the rain area extended over the central valleys and the Lake region. A secondary disturbance formed near the south Atlantic coast on the 21st, and while the principal disturbance moved to the lower lake region and the Saint Lawrence Valley, the secondary disturbance passed along the Atlantic coast, causing strong easterly gales in southern New England on the 21st. These disturbances apparently united in the northern portion of New England on the 22d, after which this storm apparently moved northeastward beyond the stations of observation.

VII.—This is the only disturbance of the month traced to the eastward of the Rocky Mountains from the Pacific coast. On the morning of the 22d it was central over Oregon, attended by heavy rains on the coast and snow in the interior. On the afternoon of the 22d it covered the northern Rocky Mountain regions. During the 23d it passed over the Dakotas and Iowa, but the weather continued fair in the Northwest. The pressure increased at the centre of this disturbance after passing to the east of the Rocky Mountains, and it disappeared to the northeast of the upper lake region during the 24th, without causing any decided change in the weather conditions within the limits of the United States.

VIII.—Apparently developed in southern Texas on the 26th. It passed rapidly to the northeastward, causing general rains, except in the Northwest and the upper lake region, where snows were reported on the 26th, 27th, and 28th. The storm increased in violence during the northeasterly movement, and the strong gales, attended by freezing weather and snow, in the

Lake region, caused much damage to shipping, although the warning signals had been displayed in advance of this storm at the lake ports. After the centre of disturbance reached the southern portion of the upper lake region, a secondary disturbance formed over the middle Atlantic states, which, however, quickly united with the principal disturbance in northern New England on the 28th. Heavy rains and severe easterly gales occurred along the New England coast as the centre of disturbance passed northeastward to the Saint Lawrence Valley, and brisk to high winds and snow continued in the lower lake region during the 29th after the centre of disturbance had passed to the northeast of the Maritime Provinces.

The following tables exhibit some of the principal facts regarding these low areas:

TABLE I.

No.	First observed.			Last observed.			Duration.	Velocity per h.r.	Lowest pressure.		
	Date.	Lat. N.	Long. W.	Lat. N.	Long. W.				Date.	Station.	Reading.
I.....	1	38°	92°	49°	85°	Days.	Miles.		2	Port Arthur, Ont.	29.32
II.....	5	55	109	50	57	1.5	28.0		7	Father Point, Quebec ..	29.58
III.....	7	31	93	42	85	1.5	28.0		7	Memphis, Tenn.	28.82
IIIa.....	8	37	82	40	70	1.5	18.0		10	Nantucket, Mass.	29.84
IV.....	10	46	112	44	62	4.0	40.0		15	Saint John's, N. F.	29.13
V.....	16	29	89	46	79	4.5	14.0		20	Parry Sound, Ont.	29.56
Va.....	17	32	82	46	67	4.5	14.0		19	Atlantic City, N. J.	29.72
VI.....	19	35	100	51	62	4.0	31.0		20	Portland, Me.	29.24
VIa.....	21	37	72	47	66	1.0	31.0		22	Chatham, N. B.	29.24
VII.....	22	43	117	46	83	2.0	45.0		22	Chatham, N. B.	29.24
VIIa.....	23	47	117	46	83	2.0	45.0		22	Fort McKinney, Wyo.	29.48
VIII.....	26	27	99	52	64	3.5	34.0		28	New York, N. Y.	29.42
Mean.....		37	95	47	71	2.7	30.5				29.40

TABLE II.

Number.	Maximum abnormal fall in pressure in twelve hours.			Maximum abnormal rise in temperature in twelve hours.			Maximum wind velocity.		
	Amount.	Station.	Date.	Amount.	Station.	Date.	Miles per hour.	Direction.	Date.
I.....	.52	Winnipeg, Man.	2	0	Sydney, C. B. I.	3	48	*	2.3
II.....	.46	Medicine Hat, N. W. T.	5	.26	Swift Current, N. W. T.	4	44	w.	7
III.....	.30	Memphis, Tenn.	7	.24	Bismarck, N. Dak.	8	36	7	7.8
IIIa.....	.22	Halifax, N. S.	9	.17	Chattanooga, Tenn.	8	48	ne.	10
IV.....	.60	Halifax, N. S.	14	.18	Montgomery, Ala.	12	48	nw.	10
V.....	.30	Louisville, Ky.	17	.13	Knoxville, Tenn.	17	36	e.	17
Va.....	.34	Norfolk, Va.	17	.15	Wilmington, N. C.	17	60	e.	19
VI.....	.34	Abilene, Tex.	19	.20	Abilene, Tex.	19	56	n.	20
VIa.....	.40	Atlantic City, N. J.	21	.19	Charleston, S. O.	21	48	se.	21
VII.....	.58	Fort McKinney, Wyo.	22	.31	Pueblo, Colo.	23	48	w.	23
VIII.....	.64	Albany, N. Y.	28	.26	Bismarck, N. Dak.	25	72	ne.	28

* S.W., w., and n.w. † N. and n.w.

NORTH ATLANTIC STORMS FOR NOVEMBER, 1889 (pressure in inches and millimetres; wind-force by Beaufort scale).

The paths of the depressions that appeared over the north Atlantic Ocean during November, 1889, are shown on chart i. These paths have been determined from international simultaneous observations by captains of ocean steamships and sailing vessels received through the co-operation of the Hydrographic Office, Navy Department, and the "New York Herald Weather Service."

Eight depressions have been traced for November, 1889, the average number traced for the corresponding month of the last seven years being 10.7. The greatest number of depressions traced was fourteen, in 1887, and the least number was seven, in 1882. Of the depressions traced for the current month, five advanced eastward from the American coast between the thirty-fifth and fiftieth parallels; one apparently moved eastward from the Labrador coast; one first appeared southeast of the Banks of Newfoundland, and one is given a track from mid-ocean in high latitudes to the north of the

British Isles. The depressions generally pursued east to north-east tracks, and in each instance the centre of disturbance passed north of the region of observation before reaching the European coast. The month opened with very low pressure over the British Isles, a barometer reading of 28.82 (732) being reported at Leith, Scotland, on the 1st. From this date until the 5th, and from the 24th to 27th, the pressure was generally low over the British Isles; during the remainder of the month high pressure prevailed in that region. Over mid-ocean on the 1st, 2d, 4th, and 5th fresh to strong gales prevailed along the trans-Atlantic tracks, attending the presence to the northward of areas of low pressure. On the 7th and 8th a depression moved northward east of the Grand Banks, and another depression passed eastward over northern Newfoundland, causing fresh to strong gales between the thirtieth and sixtieth meridians. On the 11th, 12th, and 13th, gales of hurricane force were encountered over and near the Banks of

Newfoundland, attending the passage of a depression which moved eastward from the middle Atlantic coast during the 10th, and on the 14th gales of hurricane force attended the passage of this depression over mid-ocean. On the 14th and 15th severe gales, attaining hurricane force, attended the passage of a depression south of Nova Scotia and Newfoundland and over the Grand Banks. Fresh to strong gales continued over mid-ocean from the 18th to 22d, during which period a depression was central north of the region of observation. From the 27th to 29th strong to whole gales were caused over mid-ocean by a depression which had advanced from the Gulf of Saint Lawrence, and which, on the 30th, was central west of the British Isles. From the 17th to 19th, and on the 27th and 28th, severe gales were reported off the south Atlantic coast, attending the passage of low areas v and viii.

The following is a brief description of the movements of areas of high pressure over the north Atlantic during the month: An area of high pressure which occupied the ocean between Nova Scotia and the West Indies on the 1st, extended over Newfoundland and the Grand Banks by the 2d, and thence moved southeast over the Azores by the 5th, whence it extended northeast over the British Isles by the 5th. From the 7th to 10th the pressure continued high from the British Isles to the Azores. On the 4th an area of high pressure appeared off the middle and south Atlantic coasts, and gradually extended eastward until the 8th, when it united with the area of high pressure which extended from the Azores to the British Isles, the western limit of which contracted east and northeast until the 11th, when the area covered only the British Isles and the adjacent ocean east of the twentieth meridian. On the 12th an area of high pressure moved off the New England and middle Atlantic coasts, and on the 13th occupied an elongated area extending southward from Newfoundland, after which it disappeared by a decrease of pressure. On the 15th an area of high pressure moved off the United States coast, and by the 17th presented an elongated area extending from the coast between Nova Scotia and the Carolinas southeastward to the fiftieth meridian. By the 18th this area had contracted to the northward, and on the 19th formed a small area southeast of Nova Scotia. This area moved eastward to the British Isles by the 23d, after which it probably passed over the continent of Europe. On the 23d an area of high pressure moved off the Florida and south Atlantic coasts and gradually extended east and northeast until the 28th, when the pressure was high from Newfoundland to the Azores. This area contracted to the southeastward during the 29th and 30th. On the 29th an area of high pressure appeared off the Florida and south Atlantic coasts and extended east and northeast during that and the following date.

During the last seventeen years but three storms of pronounced strength have been traced northward from the West Indies in November. In 1879 a West Indian hurricane, first located over the southeastern Bahamas, moved rapidly northward and northeastward, passing Cape Hatteras the night of the 19th, and Halifax, N. S., the afternoon of the 20th, and thence moved northeast over the Gulf of Saint Lawrence or Newfoundland. Furious gales, attaining hurricane force at sea, attended the passage of this storm, and barometer readings falling to, or nearly to, 29.00 (737) were reported by shipmasters. In 1887, on the 29th and 30th, the path of a depression was approximately located north of the West Indies, and from the 28th to 30th heavy gales, attaining hurricane force, were reported in that region. In 1888 a storm was first located northeast of the Windward Islands under date of the 17th, whence it moved westward to the Bahama Islands by the 22d, where it recurved to the northward, and moved north-northeast to eastern New England by the 28th. This storm was attended by very destructive gales off the coast of the United States from the 21st to 27th. After its recurve over the Bahamas it augmented in energy until the 26th, when minimum pressure falling below 29.00 (737) was reported, after which there was a marked diminution in energy.

Among the more notable November American storms whose influence has been severely felt off the coast are: a storm in 1873, which developed over northern Georgia on the 16th, passed off the North Carolina coast on the 17th, and over the Bay of Fundy into the Gulf of Saint Lawrence during the 18th, attended by fierce gales and fearful seas. At Norfolk, Va., the barometer fell to 28.86 (733) on the 17th. In Chesapeake Bay the storm was extremely severe. At Cape May, N. J., the barometer fell to 28.76 (730), and the gales off the coast were reported the severest in years. On the 18th at New Haven, Conn., the barometer fell to 28.72 (729); at Wood's Holl, Mass., to 28.60 (726); at Boston, Mass., to 28.61 (727), and at Portland, Me., to 28.49 (724). At Eastport, Me., the wind reached a velocity of sixty-four miles per hour at about 6 p. m. of the 18th. The storms over the Canadian Provinces were equally severe. The whole course of the storm was attended by heavy rain or snow. In 1877, during the night of the 23d-24th, when a storm which had advanced from the north Pacific coast to the south Atlantic coast was central in West Virginia, the U. S. S. "Huron" was wrecked on the North Carolina coast fifty miles north of Cape Hatteras. A southeasterly wind was blowing, with a heavy southeast swell, at the scene of the disaster.

Compared with the corresponding month of the last seven years the storms over the north Atlantic Ocean during November, 1889, were deficient in number and energy.

The following are brief descriptions of the depressions traced:

1.—This depression advanced eastward over the ocean north of the fifty-fifth parallel during the 1st and 2d, attended along the trans-Atlantic routes by moderate to fresh gales, and on the 3d was apparently central north of the British Isles, after which it disappeared to the eastward.

2.—This depression passed eastward from the Labrador coast during the 4th, and thence moved north of east to about the forty-second meridian by the 5th, after which it advanced northeastward beyond the region of observation.

3.—This depression apparently developed southeast of the Banks of Newfoundland, where it was central on the 7th, whence it moved north-northeast north of the fiftieth parallel by the 8th, with fresh gales, and passed thence northeastward beyond the region of observation.

4.—This depression was a continuation of low area ii and moved east from the Gulf of Saint Lawrence to the north of the Banks of Newfoundland by the 8th, after which it passed northeastward beyond the region of observation.

5.—This depression was a continuation of low area iii which advanced eastward from the middle Atlantic coast to about the seventy-first meridian by the morning of the 10th. Moving eastward the centre of depression passed along or near the southern edge of the Banks of Newfoundland during the 11th and thence east-northeast to the forty-fourth meridian by the 12th, after which it moved northeastward and disappeared in the direction of Iceland after the 14th. This depression was attended by probably the severest storms of the month. During the 11th, 12th, and 13th, gales of hurricane force were encountered over and near the Banks of Newfoundland, and on the 14th, when the depression was central over mid-ocean, the pressure had fallen to about 29.20 (742), and gales of hurricane force were reported.

6.—This depression was a continuation of low area iv and on the morning of the 14th was central south of Nova Scotia, whence it moved northeast to the fortieth meridian by the 16th, after which it apparently recurved westward and united with depression number 7, which had advanced northeast from southern Newfoundland. This depression was also attended by gales of hurricane force, and on the 14th and 15th barometric pressure falling below 29.00 (737) was reported.

7.—This depression first appeared over southern Newfoundland on the morning of the 16th, and was probably a subsidiary development to number 6. By the 17th the centre of disturbance had moved to the north of the Grand Banks, after which it disappeared beyond the region of observation.

8.—This depression was central off the south coast of Newfoundland on the 26th, whence it moved northeastward to the thirty-first meridian by the 28th, and during the 29th and 30th passed slowly eastward in about latitude N. 55° to the twentieth meridian. This depression was attended by storms of considerable strength, and on the 27th gales attaining hurricane force were reported over mid-ocean.

FOG IN NOVEMBER.

The following are limits of fog-areas on the north Atlantic Ocean, west of the fortieth meridian, for November, 1889, as reported by shipmasters:

Date.	Entered.			Cleared.			Date.	Entered.			Cleared.		
	Lat. N.	Lon. W.		Lat. N.	Lon. W.			Lat. N.	Lon. W.		Lat. N.	Lon. W.	
2	37 05	75 29		37 09	75 19		22	46 33	52 35		45 53	54 45	
5	46 42	47 24		46 50	40 50		22-23	47 10	44 30		45 02	51 53	
12	38 40	74 58		38 28	74 49		23	45 03	55 48		44 54	56 09	
13	37 26	75 09		37 12	75 30		25	48 34	48 30		48 12	49 11	
13-14	41 05	69 04		40 48	70 34		26-27	46 40	47 39		45 55	49 31	
20	41 08	66 10		41 05	66 20		29	46 05	55 45		45 30	59 15	
22	45 12	48 11		44 10	52 17		30	46 00	47 00		45 30	48 30	

The limits of fog-belts, west of the fortieth meridian, are shown on chart i by dotted shading. In the vicinity of the Banks of Newfoundland fog was reported on seven dates; between the fifty-fifth and sixty-fifth meridians on two dates; and west of the sixty-fifth meridian on five dates. Compared with the corresponding month of the last two years the dates of occurrence of fog near Newfoundland in November, 1889, were two in excess of the average; between the fifty-fifth and sixty-fifth meridians three less than the average; and west of the sixty-fifth meridian five less than the average. Over and near the Banks of Newfoundland dense fog was reported on the 5th, 22d, 23d, 25th to 27th, and 30th, with the approach or passage to the northward of areas of low pressure.

Between the fifty-fifth and sixty-fifth meridians fog was reported on the 23d and 29th, with the presence to the northward of areas of low pressure. West of the sixty-fifth meridian fog was reported on the 2d, with south to east winds and high pressure; from the 12th to 14th, with rapidly falling barometer and easterly winds, attending the advance from the southwestward of an area of low pressure; and on the 20th, with south to east winds, attending a depression to the westward.

OCEAN ICE IN NOVEMBER.

On chart i the positions of icebergs reported for the month are shown by ruled shading:

Ocean ice has been reported for November, 1889, as follows:
1st.—N. 46° 47', W. 48° 00', two small bergs and thirteen smaller pieces in the immediate vicinity; N. 52° 30', W. 53° 16', a large berg; N. 52° 58', W. 51° 14', a large berg.

3d.—N. 52° 01', W. 54° 25' to N. 52° 37', W. 51° 58', four bergs.

4th.—N. 46° 47', W. 48° 27', a small berg.

5th.—N. 52° 06', W. 54° 08' to the Straits of Belle Isle, several large bergs.

7th.—N. 51° 36', W. 54° 55', a large berg; in the Straits of Belle Isle, four bergs, apparently aground.

16th.—N. 44° 56', W. 49° 00', a berg three hundred feet high and eight hundred feet long.

In November, 1888, 1887, 1883, and 1882, no Arctic ice was reported near Newfoundland or the Grand Banks. In 1886 only one berg, fifty to sixty feet high, was reported, observed on the 2d in N. 45° 20', W. 45° 26'. In 1885 the only iceberg reported was observed in N. 48° 00', W. 51° 10'. In 1884 several icebergs were seen in N. 45° 56', W. 52° 38'. From the above it will be seen that during the last eight years there have been four years in which no ice was reported for November, and that for the current month the aggregate quantity reported greatly exceeded the average amount noted for the corresponding month of the last eight years.

TEMPERATURE OF THE AIR (expressed in degrees, Fahrenheit).

The distribution of mean temperature over the United States and Canada for November, 1889, is exhibited on chart ii by dotted isotherms. In the table of miscellaneous meteorological data the monthly mean temperature and the departure from the normal are given for regular stations of the Signal Service. The figures opposite the names of the geographical districts in the columns for mean temperature and departure from the normal show, respectively, the averages for the several districts. The normal for any district may be found by adding the departure to the current mean when the departure is below the normal and subtracting when above. The monthly mean temperature for regular stations of the Signal Service represents the mean of the maximum and minimum temperatures.

For November, 1889, the mean temperature was highest over southern Florida, where the highest mean reading, 76°.0, was noted at Key West. The mean temperature was above 60° on the Atlantic coast south of the thirty-second parallel, in Florida, except at extreme northwestern stations, along the west Gulf coast and in the lower Rio Grande Valley, in extreme southwestern Arizona, and in California south of the thirty-fifth parallel, and the mean temperature was generally above 50° south of a line traced from the middle Virginia coast irregularly west-southwest to extreme western Texas, and west of a line traced from southeastern Arizona northwestward to and along the immediate north Pacific coast to the mouth of the Columbia River. The mean temperature was lowest in the British Possessions north of Minnesota and North Dakota, the lowest mean reading, 20°, being noted at Minnedosa, Man. The mean readings were below 25° in the Valley of the Red River of the North and thence west of south to south-central South Dakota, over northern Minnesota, the northern part of

North Dakota, northeastern Montana, southeastern Wyoming, and central Colorado, and were below 40° north of a line traced from the east New England coast irregularly west-southwest to southern New Mexico, thence northwestward to northeastern California, and thence northward to the British Possessions.

In the United States the mean temperature was below the normal from the one-hundred and tenth meridian eastward to a line traced irregularly southeastward from Manitoba to the east Gulf coast. From the Valley of the Red River of the North eastward over the upper lake region and Canada; from the lower lake region southward over Florida; in the plateau regions; on the Pacific coast, and in the Canadian Northwest Territories the month was generally warmer than the average November. The departures below the normal temperature were greatest in central Texas and central Colorado, where they exceeded 5°. In districts where the mean temperature was above the normal the departures were less than 5°. The only station in the Atlantic coast states which reported mean temperature below the normal was Washington, D. C., where the deficiency was but 0°.8. Considered by districts the greatest average departure below the normal temperature, 4°.5, occurred on the southeastern slope of the Rocky Mountains; on the middle-eastern slope of the Rocky Mountains the average departure below the normal temperature was 4°.2; in the west Gulf states, 3°.8; in the upper Mississippi and Missouri valleys, 3°.2; in the Rio Grande Valley, 1°.8; on the northeastern slope of the Rocky Mountains, 0°.9; in the east Gulf states and over the southern plateau region, 0°.6; and in the Ohio Valley, 0°.2. The greatest average departure above the normal temperature, 3°.6, occurred on the south Pacific coast; on the middle Pacific coast the average departure above the normal tempera-